This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(10 - 3i)(8 - 9i)$$

The solution is $53 - 114i$, which is option D.

A. $a \in [103, 114]$ and $b \in [-71, -59]$

$107 - 66i$, which corresponds to adding a minus sign in the first term.

B. $a \in [75, 82]$ and $b \in [22, 30]$

$80 + 27i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [103, 114]$ and $b \in [66, 68]$

$107 + 66i$, which corresponds to adding a minus sign in the second term.

D. $a \in [50, 58]$ and $b \in [-115, -111]$

* $53 - 114i$, which is the correct option.

E. $a \in [50, 58]$ and $b \in [114, 116]$

$53 + 114i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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2. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{54 - 22i}{5 + 4i}$$

The solution is $4.44 - 7.95i$, which is option B.

A. $a \in [10.5, 11]$ and $b \in [-6, -5]$

$10.80 - 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [4, 5]$ and $b \in [-9, -7]$

* $4.44 - 7.95i$, which is the correct option.

C. $a \in [4, 5]$ and $b \in [-327, -325.5]$

$4.44 - 326.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [181, 183]$ and $b \in [-9, -7]$

$182.00 - 7.95i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [8, 10]$ and $b \in [1.5, 3.5]$

$8.73 + 2.59i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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3. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{484}{169}}$$

The solution is Rational, which is option B.

A. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

B. Rational

* This is the correct option!

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

D. Irrational

These cannot be written as a fraction of Integers.

E. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\frac{22}{13}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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4. Simplify the expression below and choose the interval the simplification is contained within.

$$9 - 2^2 + 10 \div 8 * 14 \div 20$$

The solution is 5.875, which is option C.

A. $[12.54, 13.05]$

13.004, which corresponds to two Order of Operations errors.

B. $[13.09, 14.05]$

13.875, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[5.54, 5.99]$

* 5.875, this is the correct option

D. $[4.75, 5.51]$

5.004, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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5. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{144}{625}}$$

The solution is Rational, which is option E.

A. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

B. Irrational

These cannot be written as a fraction of Integers.

C. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Rational

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\frac{12}{25}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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6. Simplify the expression below and choose the interval the simplification is contained within.

$$2 - 10^2 + 12 \div 18 * 16 \div 9$$

The solution is -96.815, which is option D.

A. $[101.69, 103.16]$

102.005, which corresponds to two Order of Operations errors.

B. $[102.58, 103.51]$

103.185, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[-98.17, -97.88]$

-97.995, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-97.84, -95.36]$

* -96.815, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-2 + 6i)(-3 - 4i)$$

The solution is $30 - 10i$, which is option B.

A. $a \in [-18, -17]$ and $b \in [-27.7, -25.5]$

$-18 - 26i$, which corresponds to adding a minus sign in the second term.

B. $a \in [30, 38]$ and $b \in [-11.3, -7.5]$

* $30 - 10i$, which is the correct option.

C. $a \in [30, 38]$ and $b \in [8.5, 13.4]$

$30 + 10i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-18, -17]$ and $b \in [24.7, 27.8]$

$-18 + 26i$, which corresponds to adding a minus sign in the first term.

E. $a \in [6, 9]$ and $b \in [-25.9, -21.2]$

$6 - 24i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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8. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{1820}{10}} + 10i^2$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

B. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

D. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

E. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{45 + 44i}{-6 + 8i}$$

The solution is $0.82 - 6.24i$, which is option D.

A. $a \in [-6.5, -4.5]$ and $b \in [-1, 1.5]$

$-6.22 + 0.96i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-8, -7]$ and $b \in [4.5, 6.5]$

$-7.50 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [81.5, 83]$ and $b \in [-7, -5.5]$

$82.00 - 6.24i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-1, 1.5]$ and $b \in [-7, -5.5]$

* $0.82 - 6.24i$, which is the correct option.

E. $a \in [-1, 1.5]$ and $b \in [-625.5, -622.5]$

$0.82 - 624.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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10. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{36}{0}} + \sqrt{238}i$$

The solution is Not a Complex Number, which is option D.

A. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

C. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

D. Not a Complex Number

* This is the correct option!

E. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.
